

## Description

High Frequency Modulating Valve that can be incorporated into a aircraft gas turbine fuel injector to control combustion instabilities

Valve modulates pilot flow of injector to obtain out of phase cancellation of combustor instabilities

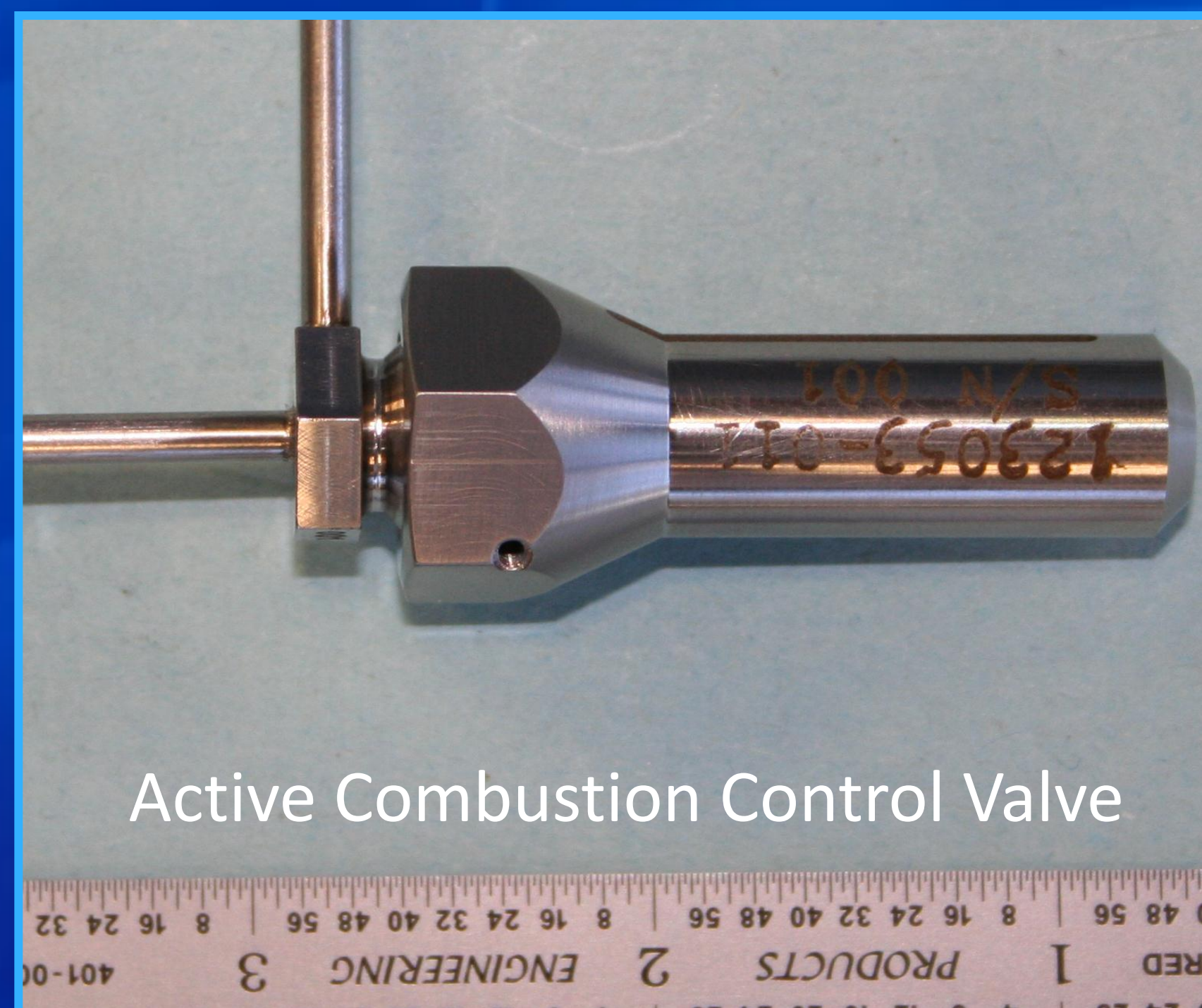
Valve has ability to modulate fuel flow at frequencies up to 1,000 Hz and at varying amplitudes and waveforms

## Benefits

Allow engines to operate leaner burning combustors without encountering combustion instabilities

Lower fuel consumption, reduced aircraft fuel burn and lower emissions

Small size allows incorporation into fuel injectors to maximize flow modulation



## Approach

Design fast acting valve that allows modulation frequency and amplitude to be varied (Modulation frequency: 0-1,000 Hz, Amplitude: 0-40%)

Cool valve using working fluid to operate in thermally harsh conditions

Piezo crystal actuation to maximize modulation capability and minimize power consumption

Current Valve designed for flow rates of 2-90 lbs/hr

Can operate at pressures to 1,000 psi

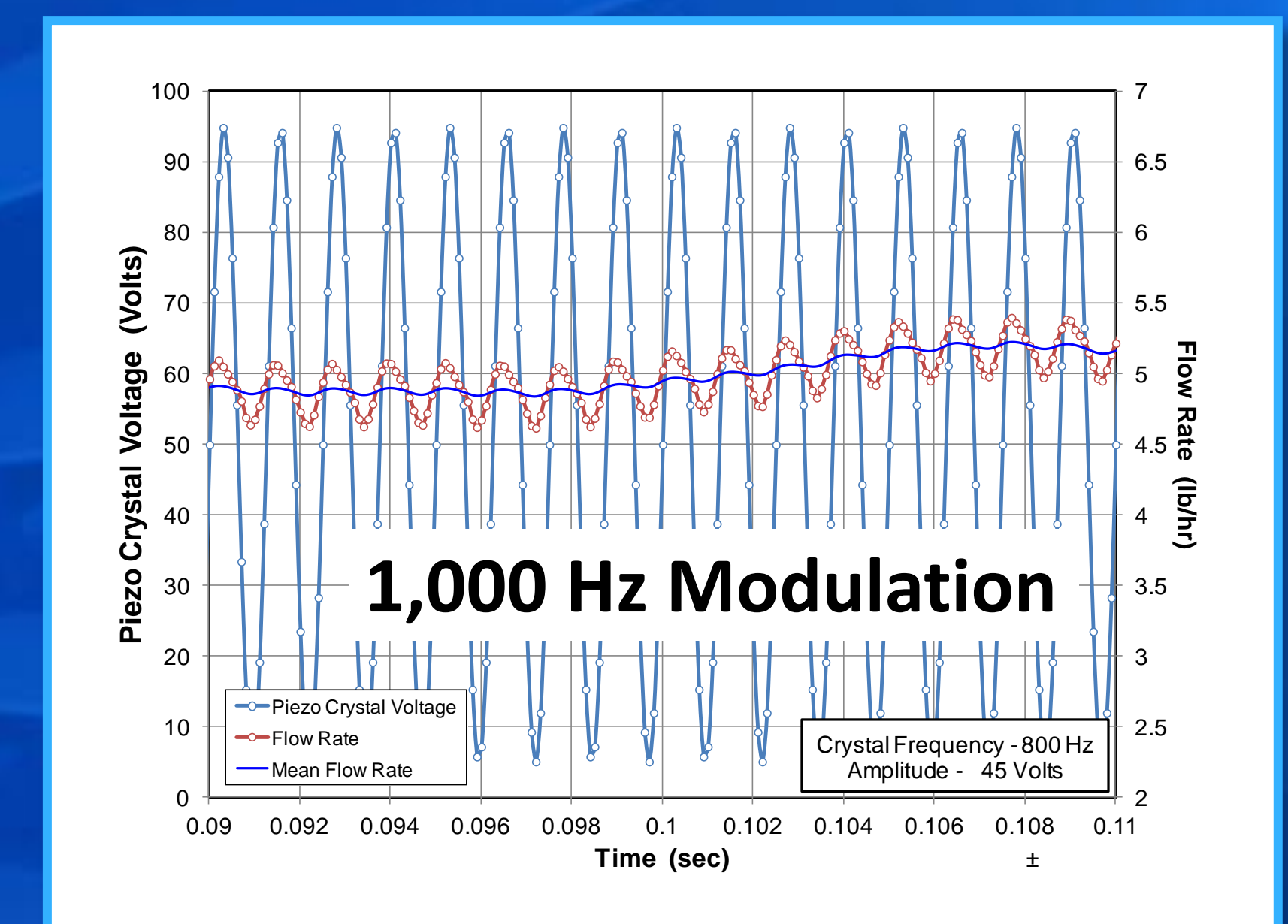
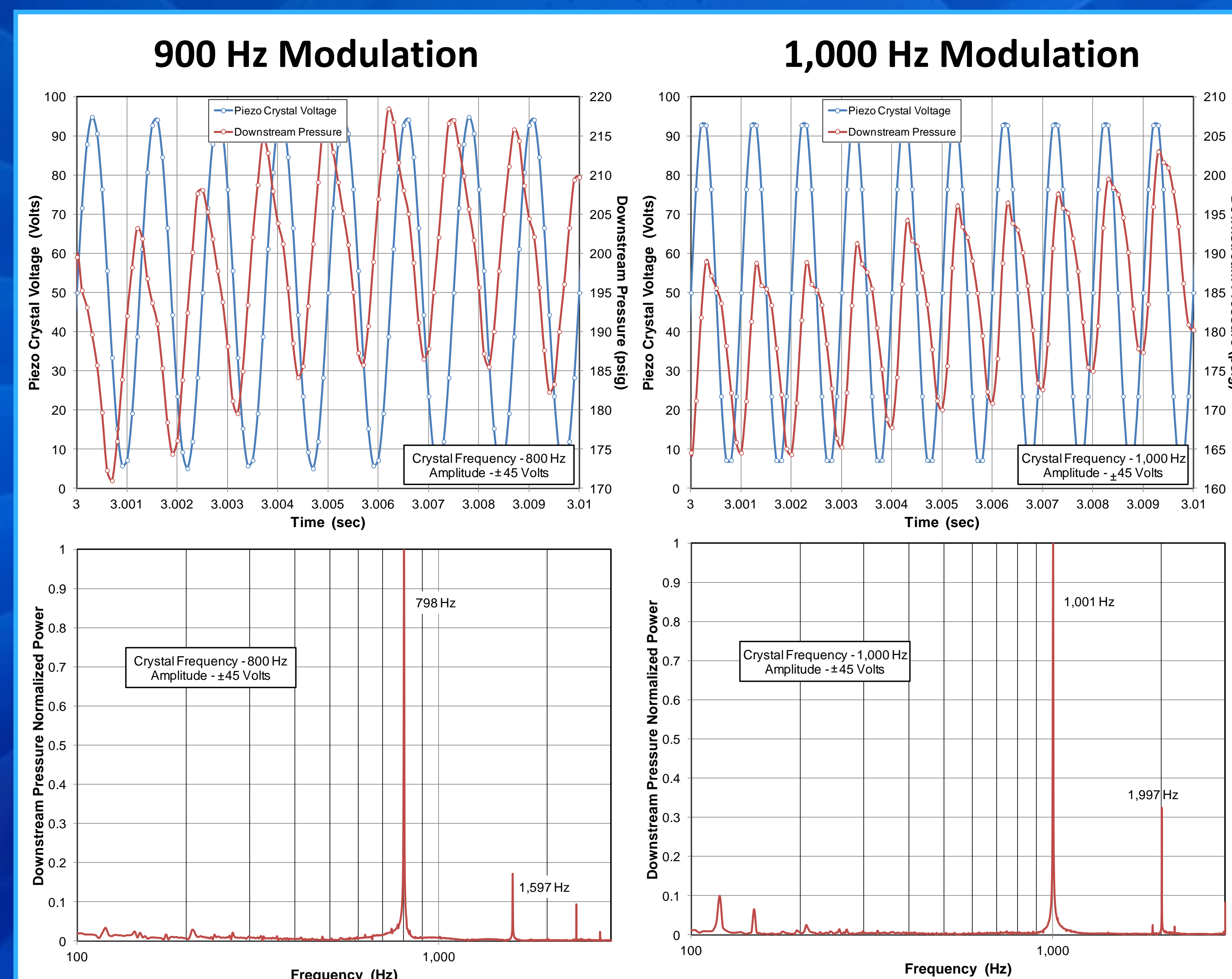
Valve can operate throttled without modulation between 10-100% open

Fail open design with 8 parts for reliability and safety

## Recent Results

Test results with Prototype Valve demonstrated ability to modulate flow at frequencies to 1,000 Hz

- Testing performed in water at modulation frequencies from 0.25 Hz to 1,000 Hz
- Tested valve with sine wave modulation and square wave modulation
- Evaluated amount and frequency of modulation on downstream pressures



## Future Work

Regeneratively cool valve with fuel to operate in harsh conditions closely coupled to fuel injector

Miniaturize control electronics

Design for specific flow/envelope requirement

